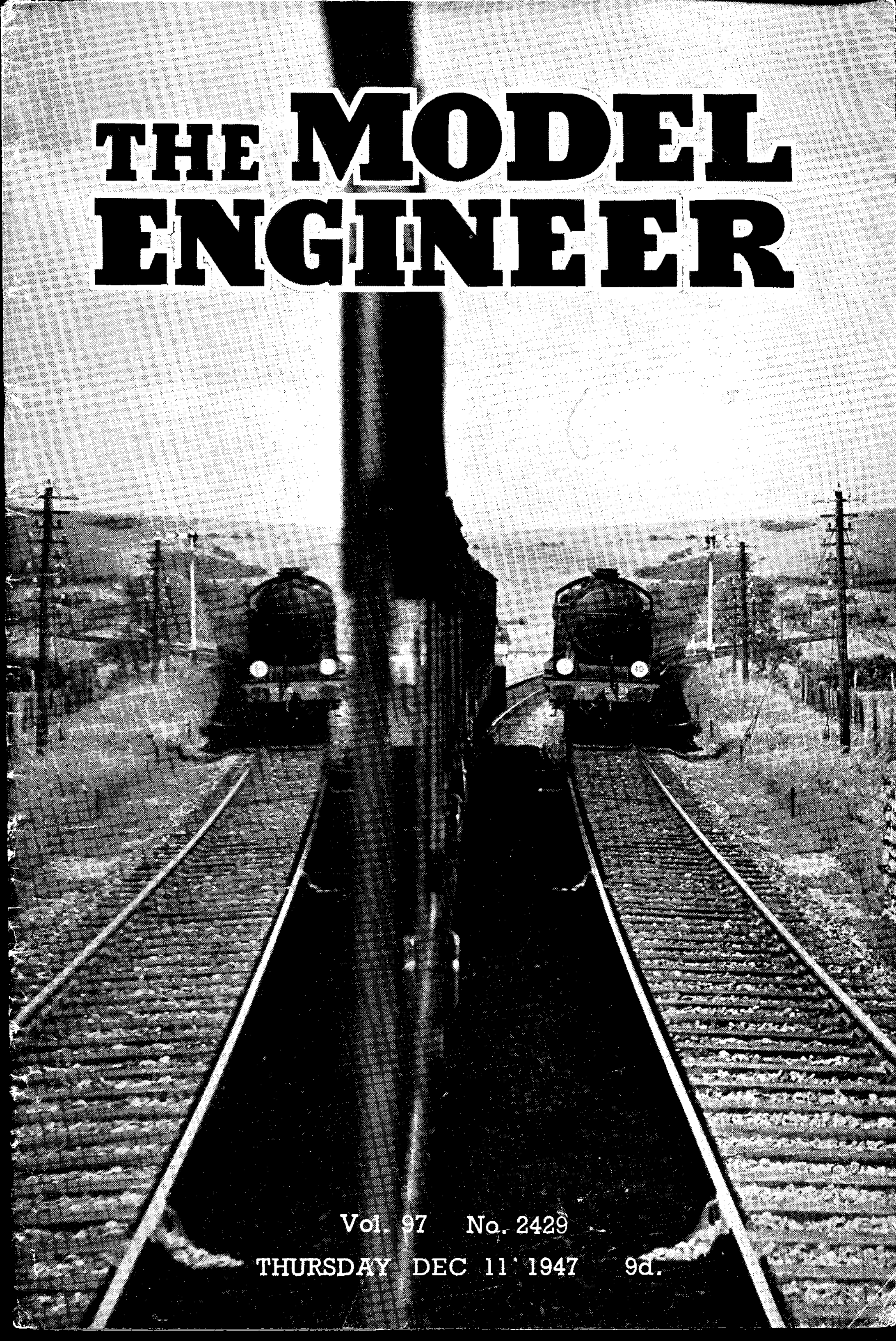
THE MODEL ENGINEER



Vol. 97 No. 2429
THURSDAY DEC 11 1947 9d.

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

11TH DECEMBER 1947 VOL. 97. NO. 2429

SMOKE RINGS

Our Cover Picture

● THIS WEEK we illustrate a particularly good example of a kind of photograph which many enthusiasts try to take. The reflecting surface of the large window, now so familiar a feature on the corridor side of main-line coaches, rather invites one to attempt such a photograph. The view we reproduce was taken in Devon, and shows Southern Railway 4-6-0 engine No. 2331, *Beattie,* on the approaching train. This engine was formerly L.B. & S.C.R. 4-6-4 express tank engine No. 331, but was converted to her present form in 1935.

Amateur or Professional

● BROADLY SPEAKING an amateur is one who does something for the sheer love of doing it without any desire for financial reward, whereas with the professional, the profit-motive, as it is called, is a primary consideration. While this interpretation of the word "amateur" does not convey any indication of the quality of the service rendered or the work produced, the word is often applied in a somewhat derogatory sense. The phrase "he is only an amateur" is sometimes advanced as an excuse for a poor performance, and yet I see no reason why this should be so. If a job is done for the love of doing it, there seems no justification for the suggestion that it should fall short in quality from one for which remuneration is expected. In art, or music, or sport, amateurs do occasionally equal or excel the professional, but in general the professional is just a shade ahead. This is perhaps natural seeing that he has usually had the benefit of a prolonged training and is more regularly and consistently engaged in his line of activity. But as regards model engineering the amateur can often hold his own at least so far as the finished product of the workshop is concerned. It is true that the professional mechanic will probably beat the amateur in speed of production, for he knows all the tricks of the trade and can employ the most expeditious methods of machining and fitting, and rarely has to do a job twice. With the amateur worker time is not a consideration, he can proceed quietly and leisurely, taking the utmost care in his work and re-making a piece if he is not satisfied with his first attempt. For this reason the final result may well bear comparison with any example of professional work, as I have often had the pleasure of observing at exhibitions and elsewhere. Despite this sincere defence of the amateur craftsman, I still have a secret dislike for the phrase "amateur engineer." To me it conveys a suggestion that the individual referred to is a "dabbler" in mechanics, to be pitied rather than praised, and not to be taken seriously. By my own argument this is wrong, and yet that derogatory interpretation of the name persists in my mind and I always avoid referring to model engineers as "amateur engineers" or "amateur mechanics" wherever possible. What is to be said of a professional engineer who makes models in his spare time simply for the interest and love of

the work, as so many of our readers do? In the strict meaning of the word he is an amateur, since his love of the work is his guiding incentive. Yet he would probably disclaim, and might even resent the appellation "amateur," but I do not think he would raise any objection to being described as a model engineer. So there is much to be said for the title adopted for our journal. I much doubt if it would ever have attained its present circulation figures if it had been called *The Amateur Engineer.* I can imagine our professional friends feeling very shy of being discovered reading or seeking information from an amateur's journal, whereas now any model engineer—amateur or professional—can look the whole world in the face with a feeling of pride that he belongs to the magic circle of model enthusiasts.

Is Speed Worth While?

● LET ME start an argument—is speed worth while? The whole world seems to be getting speed-minded, and the recent amazing flight from Edinburgh to London in half-an-hour is a symptom of the age. We must, of course, admire the technical skill which makes such a performance possible, just as we can admire the air crossing of the Atlantic in a few hours, or the water-borne crossing in a very few days. But is the world a better place and are the lives of people happier for these faster and still faster achievements of planes and trains and boats and cars? Are we sacrificing too much of the enjoyment and proper employment of life by this craze for speed? Let me examine this question for a moment in terms of model engineering. What have we to gain by achieving excessive speeds? The trials of jet-propelled model speedboats have already opened up vistas of astonishing speeds round the pole, leaving the engine-driven craft far behind at 50 m.p.h. Except for the thrill of a "whizz-bang" rush so fast that the eye can scarcely take it in, and so noisy that the ears are nearly deafened, what has jet-propulsion to offer to the true model speedboat builder? The i.c. engines and the flash steam plants, and their hulls, are full of interesting problems in design and construction; reliability of running is as difficult a target as the elusive m.p.h. Is this fascinating field of experiment to be blown out of the model engineer's programme by the roar of a floating rocket? In the model car world a new British speed record of 90 m.p.h. has just been achieved by that clever designer Mr. F. G. Buck. He and his contemporaries will doubtless soon set this record far behind, but will the flash and dash of 100, or perhaps 150 m.p.h. be really worth while, except perhaps when car racing becomes a fully organised sport? Is there not something to be said for model car construction on more conservative but still technically interesting lines, or will the jet-propelled car come to put the engine-powered car out of the picture? We should, I think, be thankful that the "live-steam" locomotive man finds that track performance in its load sense is far more interesting than the m.p.h. his engine will achieve. The prototype ship modeller is happy to see his craft afloat at a cruising speed, while in model aeronautics the question of flight duration is more absorbing than mere speed. So what are we to say about this modern craze for speed? Shall we model engineers allow ourselves to be caught up in the whirlwind, or shall we just peg along happily and quietly in our peaceful pursuit of accuracy, reliability, and praiseworthy technical perfection?

A Trevithick Model

● I AM interested to hear that the town of Bridgnorth is to have a scale model of the original Trevithick engine which was built in that town about the year 1805. This engine is preserved in the Science Museum in London, but Mr. John Pascoe feels that Bridgnorth should at least have a model, and has commissioned the building of a replica in miniature which, when completed, will be presented to the people of Bridgnorth through the mayor and corporation. It will eventually be handed over to the Historical Society for safe keeping.

A Society Birthday

● THE SUCCESSFUL society formed under the auspices of the B.O.A.C. (Croydon) has just celebrated its first birthday. The Chairman, Mr. W. G. Swain, tells me that as the result of the announcement of its formation in THE MODEL ENGINEER he has received letters from as far afield as Sydney, Australia, congratulating them on being the first B.O.A.C. organisation of the kind. I hope that other branches will follow this good lead.

Xmas Greetings from Canada

● MR. CECIL F. HARDING of Montreal sends the following happy Xmas greeting to all fellow-readers from his brother "live steamers":—"If your space for the extending of Christmas greetings to readers of THE MODEL ENGINEER is not filled up, We, the 'Live Steamers' in Montreal, would appreciate if we could send a wish for a Very Merry Christmas and Happy and Prosperous New Year to them all and hope that the coming year will be the biggest ever in The Model Engineering World. We should like readers to feel, that if they ever visit Montreal, to be sure and look us up, through our Secretary, and they would be made most welcome."

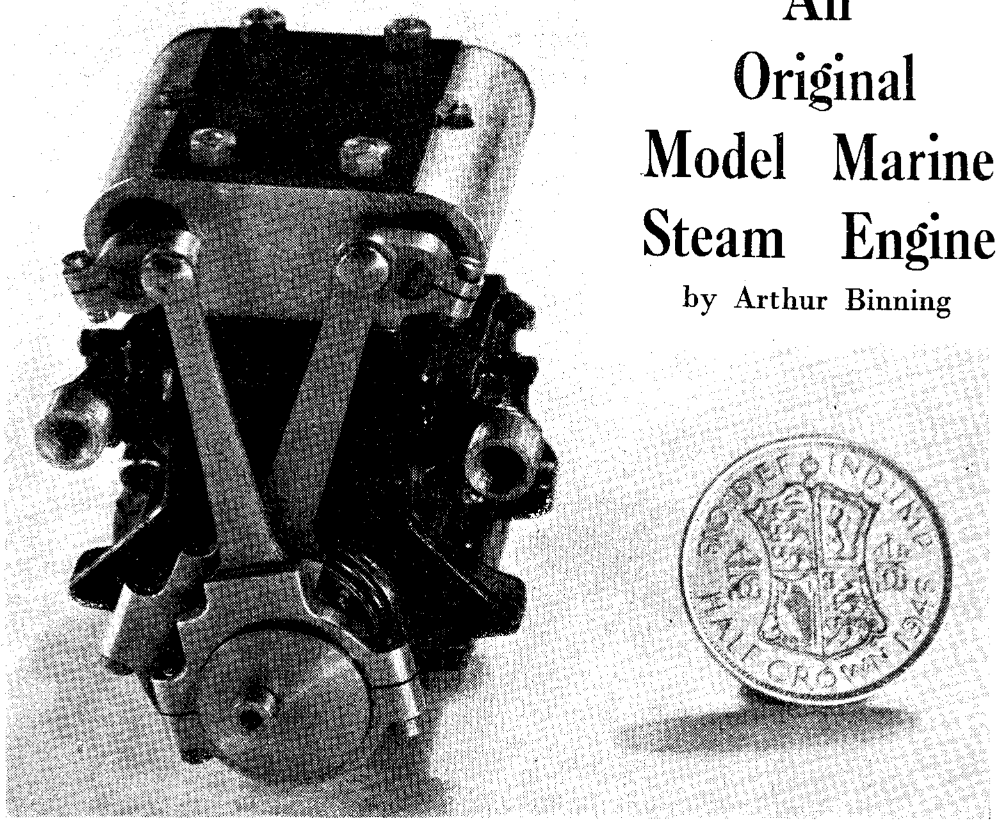
The Model Export Group

● A NUMBER of trade firms have written me expressing their interest in this proposal. Their letters have been duly forwarded to the organiser of the scheme, and I understand that a preliminary meeting in Birmingham has been arranged. There is a very general desire that the export of British made model supplies and workshop equipment should be put on a comprehensive and efficiently-handled basis, and I hope to be able to report useful progress as soon as the scheme takes definite shape. A wide field is waiting to be developed.

Percival Marshall

An Original Model Marine Steam Engine

by Arthur Binning



THE engine described here is intended to power a 30-in. model of a typical Scottish trawler of the type seen at Leith or Granton. It is of the enclosed twin-cylinder, single-acting type, of classical basic design, that is, from sump to cylinder-head joint face, being similar to the well-known "Sun" and "Star" engines of Stuart Turner. Here the similarity ends, however, as the cylinder-head and valves are totally different, as can be seen in the sectioned pictorial view.

The original aim of the design was lightness, therefore, the obvious choice of material was aluminium alloy, actually to specification DTD424 which is a good all-round alloy, being easy to machine, there being little tendency for swarf to "build-up" on the tools and is easy on small taps for the same reason.

When heat-treated it possesses these qualities to an even greater degree.

Having chosen light alloy, which inferred the use of liners, it was decided to cast these in the cylinder block casting, rather than press them in. These liners, which are of chill-cast phosphor-bronze, were made up from old aero engine valve guides. These can be seen at "*A*" on the "anatomical" view of engine (Fig. 1). The "casting-in" process was also adopted for the valve liners in cylinder-head, which is marked "*B*" on same view.

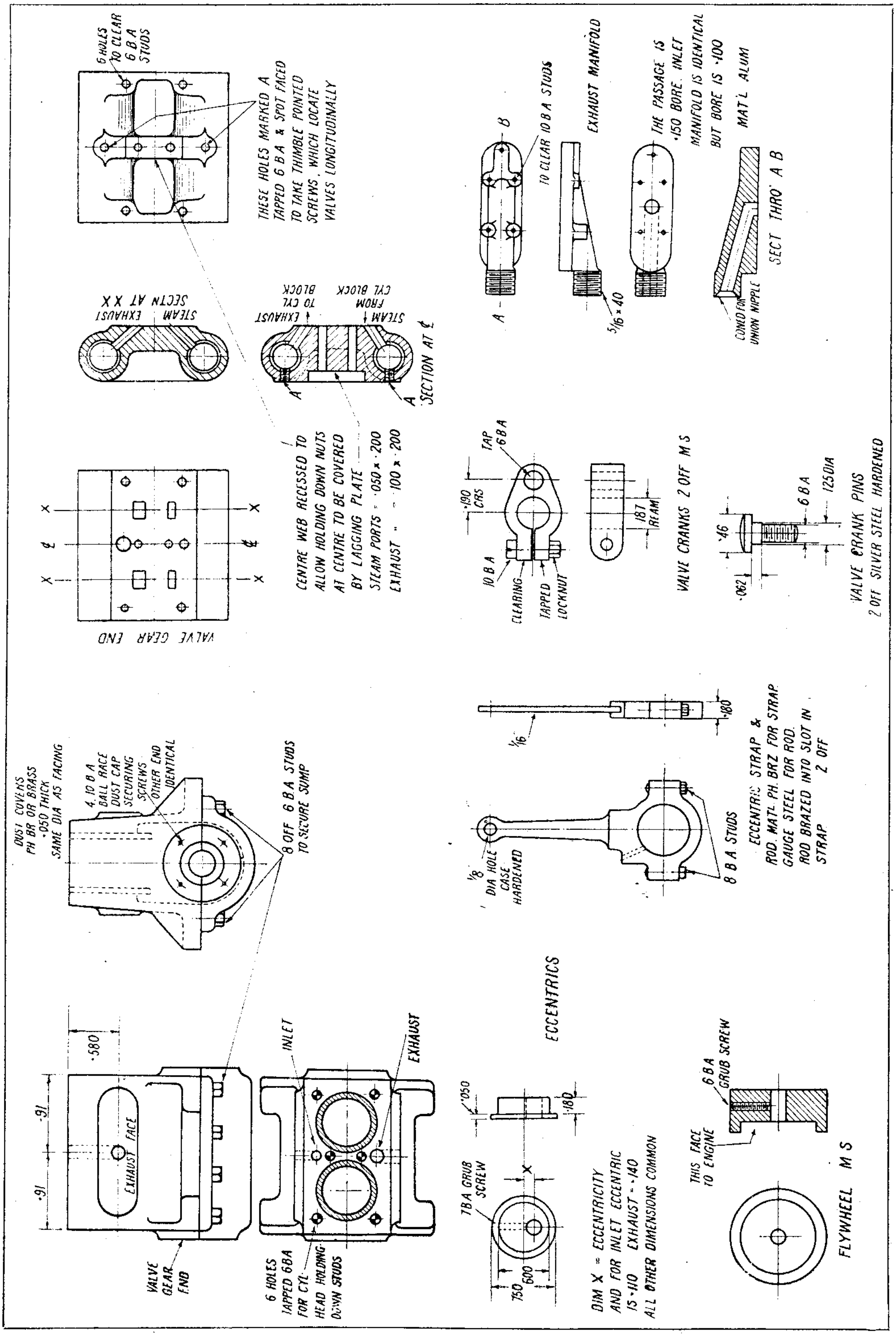
The crankshaft is constructed entirely on the press-fit system, having no brazed or pinned joints, and is of silver-steel. It runs on two 3/16-in. bore ball-races.

The connecting-rods, of phosphor-bronze, are made from the calibrated bar from an old bomb-sight and have strap type big-ends, this type being chosen in order to keep down the breadth of the crankcase.

Pistons are of gunmetal, and are fitted with $\frac{1}{8}$-in. diameter gudgeon-pins, again of silver-steel. The sump, which contains the lower half of both ball-race housings, is attached to cylinder block by eight 6 B.A. studs, the ball-races being protected from dust by bronze dust caps, attached by four 10 B.A. screws. The dust caps, by the way, were machined from old coins.

The cylinder-head, which I regard as the heart of the engine, possibly possesses the greatest interest, because, to me it is original, though I should not care to dispute this, particularly in the columns of THE MODEL ENGINEER.

Its design constituted an evasion of gear-cutting problems, as I possess neither the skill nor the tackle to make the bevels, necessary to the operation of a slide or piston valve, which is the normal method of steam distribution, and I thoroughly abhor the ball and socket-cum-bell crank, which is the other common method.


6 HOLES TO CLEAR 6 B A STUDS
THESE HOLES MARKED A TAPPED 6 B A & SPOT FACED TO TAKE THIMBLE POINTED SCREWS, WHICH LOCATE VALVES LONGITUDINALLY
EXHAUST MANIFOLD
THE PASSAGE IS ·150 BORE. INLET MANIFOLD IS IDENTICAL BUT BORE IS ·100
MAT'L ALUM
10 CLEAR 10 B A STUDS
SECT THRO' A B
CONED FOR UNION NIPPLE
5/16 × 40
SECTN AT X X
STEAM
EXHAUST
STEAM FROM CYL BLOCK
EXHAUST TO CYL BLOCK
SECTION AT ℄
CENTRE WEB RECESSED TO ALLOW HOLDING DOWN NUTS AT CENTRE TO BE COVERED BY LAGGING PLATE
STEAM PORTS = ·050 × ·200
EXHAUST " ·100 × ·200
VALVE GEAR END
TAP 6 B A
·190 CRS
·187 REAM
10 B A
CLEARING
TAPPED LOCKNUT
VALVE CRANKS 2 OFF M S
·46
6 B A
·125 DIA
·062
VALVE CRANK PINS 2 OFF SILVER STEEL HARDENED
DUST COVERS PH BR OR BRASS ·050 THICK SAME DIA AS FACING
4 10 B A BALL RACE DUST CAP SECURING SCREWS OTHER END IDENTICAL
8 OFF 6 B A STUDS TO SECURE SUMP
1/8 DIA HOLE CASE HARDENED
8 B A STUDS
ECCENTRIC STRAP & ROD. MAT'L PH. BRZ FOR STRAP GAUGE STEEL FOR ROD. ROD BRAZED INTO SLOT IN STRAP 2 OFF
1/16
·180
ECCENTRICS
·580
·91
EXHAUST FACE
VALVE GEAR END
INLET
EXHAUST
6 HOLES TAPPED 6 B A FOR CYL HEAD HOLDING DOWN STUDS
·050
·180
7 B A GRUB SCREW
·750
·600
DIM X = ECCENTRICITY AND FOR INLET ECCENTRIC IS ·110 EXHAUST = ·140 ALL OTHER DIMENSIONS COMMON
6 B A GRUB SCREW
THIS FACE TO ENGINE
FLYWHEEL M S

So with these points in mind, I set out to devise a valve of semi-rotary type, which could be oscillated by a direct drive from a single eccentric. This valve was to control admission only, exhaust being effected by a port which would be uncovered by the piston on the " Uniflow " system. But again, I could not reconcile myself to the use of compression release or auxiliary exhaust valves, and after all, the real reason for the " Uniflow " was not, I believe, to effect a freer exhaust, but to eliminate the alternate heating and cooling of the cylinder walls at admission and exhaust strokes respectively, so that put paid to the " Uniflow " idea.

The next logical step was two valves, one for admission and one for exhaust, and for this purpose two eccentrics were required. Now, the great feature of this, was, that I could take advantage of a very desirable possibility here, and give the exhaust valve a travel suited to its own particular function, and the inlet valve could be arranged with a different travel, suited to its own needs, and so, this was the design finally arrived at. Now, dear readers, do not jump up *en masse* and tell me that separate valves are not new ; I am well aware of this, as they have been discussed in THE MODEL ENGINEER. I have also seen a well-known make of engine for driving fans and pumps and other types of auxiliaries, having separate steam and exhaust valves ; this was a small engine, but the Corliss, Drop and other types of modern mill engines have this feature.

To return to the " little 'un," however. The general appearance of the cylinder-head should be apparent from the pictorial view, and with one-half of valve exposed by the cut section, the other half, serving the rear cylinder, concealed by the " solid " portion of sketch. I have endeavoured to show the inlet-valve bobbin, this being marked " *C* " on sketch. I have not shown the exhaust-valve bobbin in the sketch, as it would have confused the issue ; sufficient to say, that it is similar in appearance to the inlet valve, but has much larger passages cut in it. It occupies the liner marked " *D* "

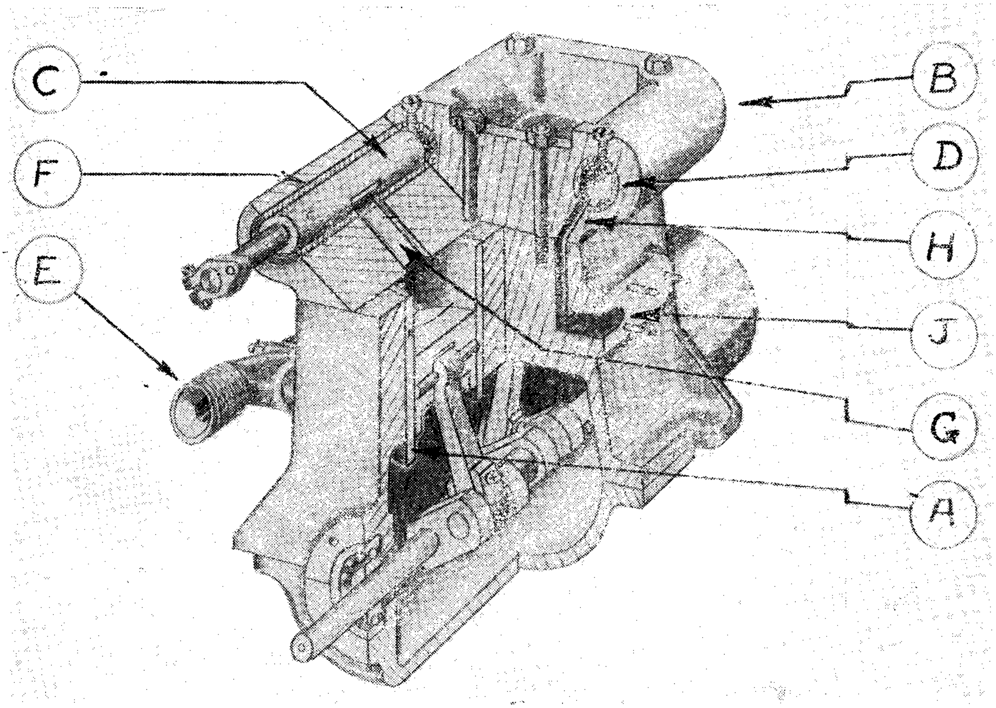


Fig. 1. " *Cut away* " *view of the engine*

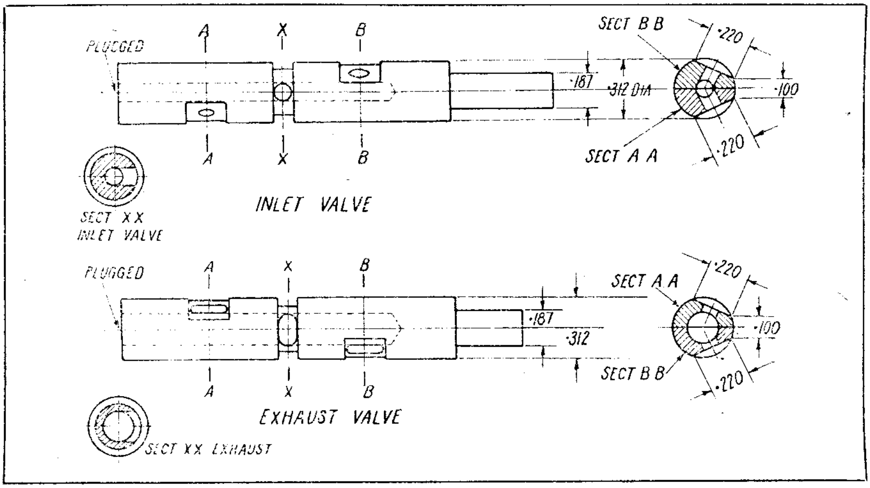
For the same reason I have omitted the eccentrics which drive the valves, but these should show clearly in the photographs.

The cycle of operations is this : live steam from boiler enters manifold, marked " *E* " on sketch, passes along this, enters cylinder block at a point midway between cylinders, then up vertically through block, into an angled port in cylinder-head. This port is drilled through inlet valve liner " *F*," and leads into an annular groove turned in valve body. The valve bobbin is hollow, but closed at both ends. Now, a hole drilled through the annular groove connects with the hollow centre of valve. In this way it will be seen that the centre of valve is always filled with live steam. At an equal pitch on either side of this annular groove, and coincided with cylinder axes, a flat is formed on valve bobbin, and this flat is also drilled through to connect with steam-loaded centre of valve. As these flats are out of line with each other, while inlet ports in cylinder-head casting are in line

(viewed in end elevation); it will be seen, that, by giving the valve a partial rotation, steam will be admitted to one cylinder then to the other cylinder alternately, cranks being set at 180 deg. to each other. One of the steam ports is shown clearly where the cylinder-head has been sectioned, and is marked "*G.*"

the straps, of phosphor-bronze, are slotted $\frac{1}{16}$-in. wide, to receive the $\frac{1}{16}$-in. gauge steel eccentric-rods. These are silver-soldered in.

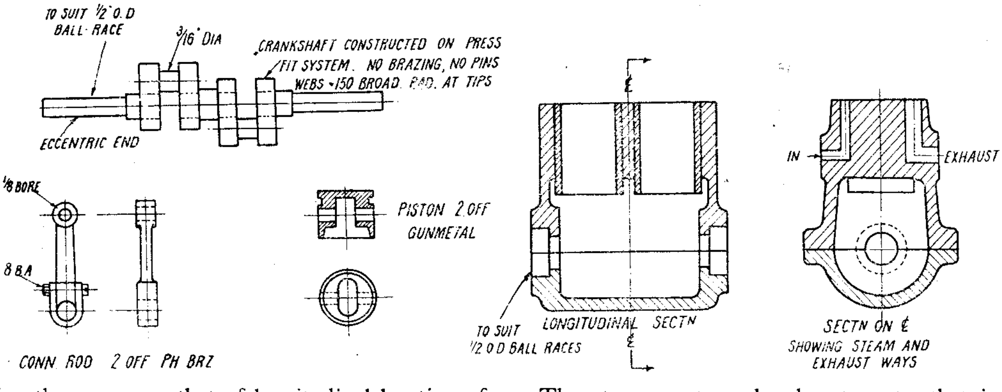
The eye on the end of these rods, which is hardened and tempered, engages the valve crank by means of a shouldered silver-steel screw. These screws are also hardened throughout,



The exhaust is similar (but in reverse, naturally), and although the exhaust valve is not shown in the sketch, the passage through cylinder-head which connects with an annular groove in exhaust-valve bobbin can be clearly seen at "*H*," leading to vertical passage down through cylinder-block and out through exhaust manifold facing at "*J*."

The annular groove in both valves serves

as, owing to the small diameter of shoulder portion, actually only $\frac{1}{8}$ in., it was considered that fairly severe wear would take place. The valve cranks are clamped to the valve bobbins, which are reduced to 3/16-in. diameter at this portion, by 10-B.A. steel screws, the crank having a 0.015-in. slot cut in it to allow screw to pull it together. These features should be clearly discernible in the photographs.



another purpose, that of longitudinal location of the valves. It was deemed unnecessary to apply covers to the end of valve liners, so a thimble-pointed 6 B.A. grub-screw was tapped through cylinder-head at a point coincident with the groove in valve bobbin, the point being a clearance fit in groove, thus locating bobbin but not binding it.

The exhaust and inlet eccentrics, which are of mild-steel, are locked to shaft by 7-B.A. grub-screws, drilled through strap journals, while

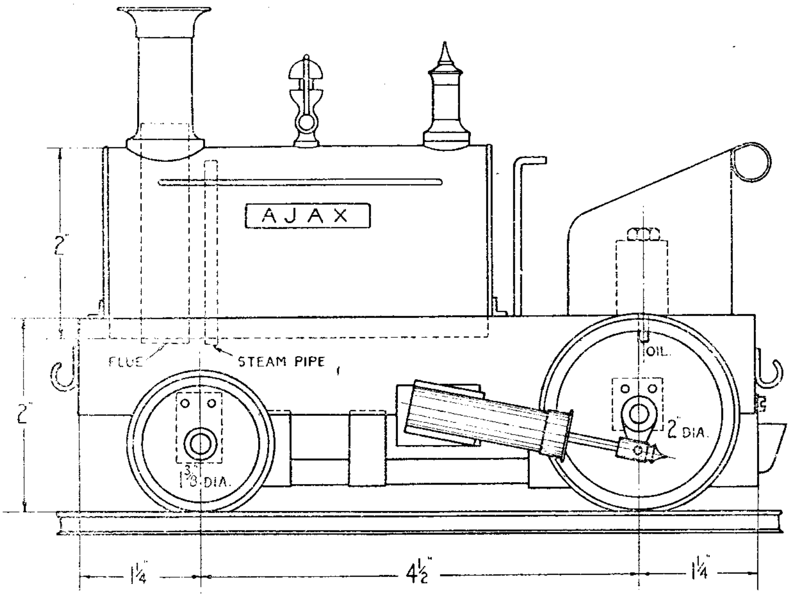
The steam ports and exhaust ports, that is, the passages connecting valve liners with cylinders, were formed by an unusual method, being actually cored out by wood cores. The method results in a clean and precise port, although the steam ports are only 0.200-in. broad by 0.050 in. in cross section. With the Editor's permission, these will be described later, in an article on the foundry and pattern shop aspect of the engine.

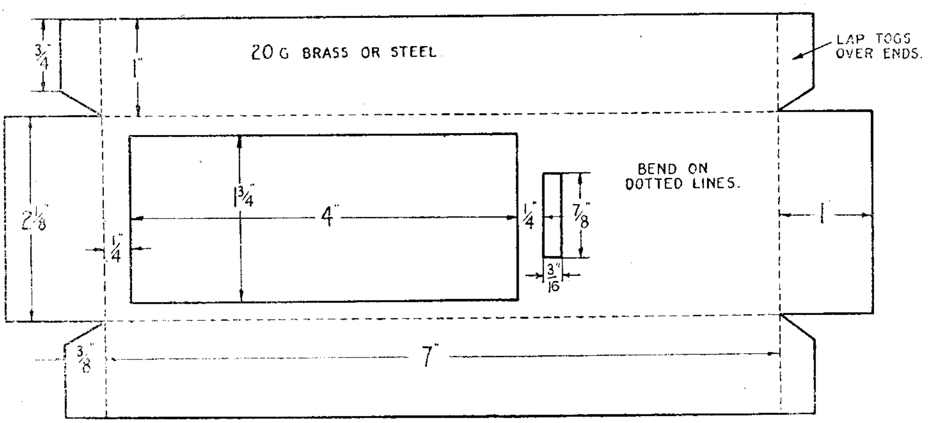
(*To be continued*)

A Bit of Ancient History

by "L.B.S.C."

NOW for another "request item." As mentioned some little time ago, certain followers of these notes who were interested in my reminiscences of childhood days, expressed a desire to build one of the toy locomotives of the type that delighted the heart of young Curly; improve its steaming and pulling powers to an extent that would just about have sent me crazy, had I known at the time how to do it. Incidentally, as I am just scheming out the general arrangement and first details of the promised five-inch jobs, and they say "a change of work





The frames "in the flat"

is the best rest," this forms an acceptable interlude. I have one of the little engines here now, partly for its historical interest, and partly from a combination of sentiment and curiosity. Well, here is a short account of how to build a replica of my "very first." My engine wasn't exactly up to present-day standards of efficiency, so I have added a few refinements, which will and it is intensely amusing to stand it between "Tugboat Annie" and "Jeanie Deans," and let my mind wander back for sixty years or so!

Frame and Wheels

The frame is like the lid of a cardboard box, and is made from a piece of sheet brass or steel about 20-gauge; or a piece of stout tin will do just as well. The overall size of the piece needed is 9-in. long and $4\frac{1}{8}$-in. wide. Mark out as shown, then cut away the ends to form the riveting tags. Cut out the opening for the boiler before bending, either with a metal-piercing saw, or by drilling holes all around, breaking out the piece, and filing to outline. Then bend on the dotted lines, turn the tags around at front and back, and put a couple of $\frac{1}{16}$ in. rivets in each. All bending can be done by aid of an ordinary bench-vice.

The bearings for the wheels are $\frac{3}{4}$-in. lengths of $\frac{1}{2}$-in. by 3/32-in. brass strip, or they can be cut from 3/32-in. brass sheet. Drill with No. 12 drill for $\frac{3}{16}$-in. axles, and rivet them to the inside of the frame, with a couple of $\frac{1}{16}$-in. rivets in each. As the centre of the driving axle lines up with the bottom of the frame, file a half-round nick in it to clear. The centres of front bearing holes are $\frac{5}{16}$ in. below bottom edge of frame, if the given size of wheel is used; but any other sized wheel available can be worked in if the axle holes are arranged so that the frame is level. The wheels are light brass castings, leading $1\frac{3}{8}$-in. diameter, driving 2-in. diameter, and may either be screwed or pressed on to the $\frac{3}{16}$-in. axles, just as you prefer. Mine were screwed; but unless the threads are tight, the driving wheels may shift and upset the 180-deg. setting of the crankpins. These are made from 3/32-in. round steel, and are screwed into the wheel bosses, at $\frac{3}{8}$ in. from centre, exactly opposite each other.

Cylinders and Steam Blocks

The cylinders are made from two pieces of $\frac{7}{16}$-in. brass treblet tube, $1\frac{5}{8}$ in. long. One end is plugged with a disc of brass 3/32 in. thick, squeezed in and soldered. The other end has a press-on cap, made from a piece of brass tube $\frac{1}{4}$ in. long and $\frac{7}{16}$-in. bore, silver-soldered to a disc $\frac{9}{16}$-in. diameter, with a No. 40 hole in the middle, and a $\frac{1}{16}$ in. air vent near the side. The caps can, of course, be turned from the solid, using $\frac{9}{16}$-in. brass rod; or they may press into the bore instead of over the outside, if you prefer it. Their only function is to guide the piston-rods.

A block of brass, $\frac{9}{16}$ in. wide, $\frac{3}{4}$ in. long and $\frac{3}{16}$ in. thick, is soldered to the side of each cylinder at the closed end. This is recessed out with a round file, to the radius of the cylinder barrel, and to a depth of $\frac{1}{16}$ in., so that the flat face is $\frac{1}{8}$ in. from the barrel. Bevel off each side as shown. Two holes are drilled on the centre-line of this, for steam port and trunnion, like the pumps in my mechanical lubricators. The port is drilled 3/32 in., at $\frac{1}{8}$ in. from the end, right into the cylinder. The trunnion hole is drilled $\frac{3}{8}$ in. farther along, using No. 40 drill, and tapping $\frac{1}{8}$ in. or 5-B.A.; and take care not to make any indentation on the cylinder barrel. True up the rubbing-face of the block on a bit of emery-cloth laid on something flat, same as slide-valves, and screw in a trunnion-pin made from $\frac{1}{8}$-in. silver-steel, screwed at both ends and furnished with a nut.

The piston is $\frac{1}{2}$ in. long, turned and fitted exactly as I have described for pistons of all engines in this series of notes. The piston-rod is made from 3/32-in. round steel (rustless for preference), $1\frac{1}{2}$ in. long, screwed both ends. The big-end is turned from $\frac{3}{16}$-in. brass rod, screwed on to the end of the piston-rod, and cross-drilled No. 40 for the crankpins. Why on earth the original makers of the "Ajax" engines fitted big-ends of this fancy pattern, goodness only knows; I don't know of anything like it in full-size practice. Plain round bushes, with the piston-rod screwed in edgewise, or ordinary rectangular blocks, would have done quite as well and been more realistic. The pistons are packed with graphited yarn, and should not be mechanically tight; they should work with as little friction as possible.

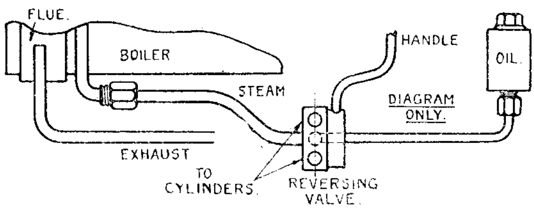
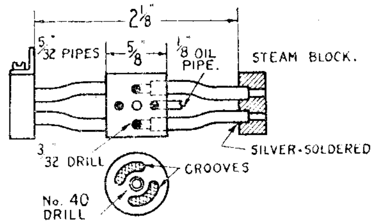


Diagram of pipe connections



How to connect reversing valve

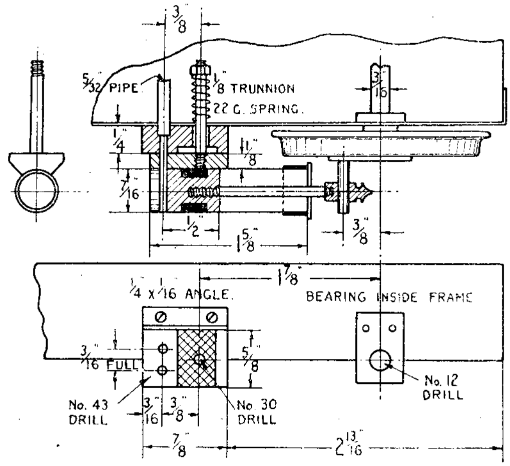
Two pieces of $\frac{5}{8}$-in. by $\frac{1}{4}$-in. brass bar, $\frac{7}{8}$ in. long, are required for the steam distribution blocks. Each of these is drilled with three holes, as shown in the illustration; and a recess about $\frac{1}{16}$ in. deep is filed across the No. 30 hole. The backs of the No. 43 holes are slightly counter-bored to take 5/32-in. pipes. A small piece of $\frac{1}{4}$-in. by $\frac{1}{16}$-in. brass angle is attached to the upper end of each, for fixing to the engine frame. File a clearance in it to correspond with the recess in the block. Both blocks must be truly faced.

Reversing-valve

Young Curly's engine only went one way, chimney first, but there is more fun to be got out of the little toy if it goes both ways, so I am specifying a simple reversing-valve. Incidentally, in the old book on making simple steam engines, by "Steady Stoker," published in my childhood days, there was a description of a simple locomotive with four wheels and oscillating cylinders, and the steam-pipe connections were so arranged that the engine ran backwards only! Probably our friend the "stoker" had got a few cinders

in his eye when running chimney first, so had taken due precautions. Old "Tishy" presented me with a nice hot specimen the other evening, and it was pretty painful for quite an hour afterwards.

Another piece of $\frac{3}{8}$-in. by $\frac{1}{4}$-in. bar, $\frac{5}{8}$ in. long, will make the reversing-valve distribution-block. Drill a No. 48 hole in the middle, and tap it 3/32 in. or 7-B.A. for a trunnion-pin, similar to those on the cylinders. On a circle $\frac{3}{8}$ in. diameter, set out four holes as shown. Drill the top and bottom ones half through the block,

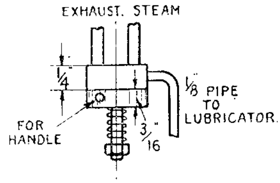


"The works"

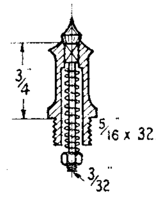
the centre of the driving-axle. Young Curly used to check his with a bit of tightly-stretched sewing cotton, which did the trick fine. Put the cylinders on, give the moving parts a drop of oil, and connect a tyre pump to the free end of the steam-pipe in the reversing-block. The wheels should spin freely in either direction, according to position of the reversing-valve.

Boiler

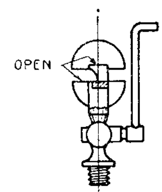
The boiler is merely a 4-in. length of 2-in. diameter brass or copper tubing, the lighter the



Plan of reversing valve



Safety valve



"Squeaker" whistle

and the side ones right through; counterbore the latter at the back, to take 5/32-in. pipes. Drill two 3/32-in. holes through the thickness of the block, level with the top and bottom holes in the face, and breaking into them. Counterbore these each side, to take 5/32-in. pipes (see dotted lines in illustration); then drill a $\frac{1}{16}$-in. hole between them, into the steam port, and counterbore it $\frac{1}{8}$ in. for the oil-pipe. Face the four-hole side truly, same method as used for cylinder port faces and so on; then connect the valve-block to the steam-blocks with bits of 5/32-in. pipe as shown in the drawing. Put a piece of $\frac{1}{8}$-in. pipe about 2 in. long in the oil-hole at side of block; a piece of 5/32-in. pipe about $2\frac{3}{4}$ in. long in the steam hole, and another piece of 5/32-in. pipe about $4\frac{1}{2}$ in. long in the exhaust hole. Silver-solder them all in at one heat. Fit a 3/32-in. trunnion-pin as shown; then make the valve from a $\frac{3}{16}$-in. slice of $\frac{5}{8}$-in. round rod. This has two sausage-shaped grooves in it, about $\frac{1}{16}$ in. deep, and a No. 40 countersunk hole in the middle. It has also a $\frac{1}{8}$-in. or 5-B.A. tapped hole in the edge for the "walking-stick" regulator-cum-reversing-handle. A fairly stiff spring and nut holds the valve to the block. The valve must, of course, be truly faced.

The whole assembly is attached to the frames by a couple of screws through each angle, nutted inside the frames. The hole for the cylinder trunnion should be $1\frac{7}{8}$ in. ahead of the centre-line of the driving-axle, and a line drawn midway between the ports, passing across the centre of the trunnion-hole, should cut across

better, within reason, as the pressure is very low, and thin-gauge metal gives better results with spirit firing. Alternatively, it can be rolled up from 22-gauge sheet copper. Two light flanged ends can be silver-soldered on, and a piece of $\frac{1}{2}$-in. by 22-gauge tube goes through one end, to form an exhaust flue. Two small brackets, made from odd scraps of copper or brass, bent in the bench vice, are silver-soldered to the ends, at $\frac{1}{4}$ in. from the bottom. When the boiler is in position on the frame, these brackets rest on the frame at the ends of the rectangular hole, and a couple of $\frac{1}{16}$-in. screws through each, with nuts underneath, will keep the boiler central.

The mountings consist of a chimney, "peanut" squeaker whistle, and a safety-valve with internal spring, both the latter being screwed into bushes silver-soldered into the boiler. The chimney can be spun up from a bit of $\frac{9}{16}$-in. brass tube, or turned from a casting. The whistle is just an "organ-pipe" whistle with the top cut short, and a hollow dome or inverted cup fixed on it, to give a little deeper note. It squeaks, anyway, as the dome is too small for a proper tone. The lower part is simply a cup, fitting on the stem of the whistle under the sound opening, and the whole doings is mounted on the end of a plug-cock, screwed into the bush on the boiler. The safety-valve is shown in section, and needs no comment; the wire stem is screwed into the valve head, which has three flats filed on it to allow steam to pass.

Steam is collected by a 5/32-in. pipe silver-soldered into the bottom of the boiler and reach-

ing almost to the top. A union screw is attached close to where it emerges, and a union nut and cone is fitted to the end of the steam-pipe coming from the reversing-block. When these are coupled up, the pipe should be bent so that it will be directly in the lamp flame. The end of the exhaust pipe is bent to go up the flue tube, the pipe being set to one side of the chassis, clear of the lamp flames. A small drum lubricator, made from a $\frac{3}{4}$-in. length of $\frac{1}{2}$-in. brass tube, is installed in the middle of the frame at the back end, and the oil-pipe coming from the reversing-block can either be soldered direct into it, or attached by a union. The "walking-stick" is bent so that it projects upwards through the slot in the frame behind the boiler.

The tank of the spirit lamp can be made of thin brass, or stout tin. It is $2\frac{3}{8}$ in. long, $\frac{3}{4}$ in. deep, and about 2 in. wide, to clear the wheel bearings. The back is made a little higher than the sides and front, so that the tank can be attached to the back of the frame by two 3/32-in. screws. A strip of brass, about 3/32 in. thick, is soldered along the back, inside the frame, and the holes for the screws are drilled and tapped through this, as nuts cannot be got on with the lamp tank in place. The feed-pipe is $\frac{1}{4}$-in. brass tube, and the wick tubes $\frac{3}{8}$ in. diameter and $\frac{7}{8}$ in. long. The lamp on Curly's toy slid between two runners soldered to the frame, but every time the tank was slid in or out, the wicks caught the steam-pipe and were pulled out. The lamp can be filled *via* a socket soldered to the back of the tank as shown, with a hole drilled in the tank for the spirit to enter ; or you can fit a vertical pipe, and drill a hole beside the lubricator, through which the filler pipe can project into the "tender."

The "tender body" is bent up from sheet brass, steel or tin, and soldered to the top of the frame. The back is turned over as shown, so that the engine may easily be picked up by holding the back, the rolled-over part forming a convenient grip. Young Curly found this very handy, having tender fingers in those days. They are apparently made of asbestos now ! The coupling-hooks are made of wire, bent to shape, the end being flattened, drilled, and attached to the engine frame by a single rivet. The handrails are tinned wire.

Curly's engine was painted bright green, with black frame. The chimney, safety-valve, whistle and cylinders were polished brass, and the handrails left bright. The wheels had bronze-coloured spokes.

Well, there you are ; the little toy is worth building, just for curiosity if nothing else, and actually takes a matter of hours only. Though only suitable for indoor working, or on a calm day outdoors, there is a peculiar fascination in seeing it at work. I built one for a friend in Liverpool, as a reminder of old times (her name was "Bjill," not "Bill" as misprinted in a recent issue) and one of the funniest sights I ever saw on my railway was "Bjill" piloting old "Ayesha." The energetic way the little toy tugged at the front drawbar hook of her sedate coal-fired passenger-hauling sister, as though to say, "Come along, let's get on with the job," was really comical.

Early Passenger-hauling

Whilst on the subject of "ancient history," during the past few weeks some correspondence has come to hand on the subject of live passenger hauling on small gauges, asking for information on this subject ; and as there is apparently some misapprehensions floating around, I'll tell you here what I know about it. The first living passenger to ride *in public* behind a $3\frac{1}{2}$-in. gauge locomotive was none other than Mr. Percival Marshall, the engine being a Caledonian 4-4-0 of the Dunalastair class. The information, as far as I recollect, came from Mr. A. P. Whatley, one of the earlier members of the London S.M.E., who was present at the Holborn Town Hall. I understand that the engine slipped very badly, but she did the job. About the same time (the opening years of the century) Mr. Jack Wood, of Winnipeg, built a $3\frac{1}{2}$-in. gauge Canadian Atlantic which managed to pull a passenger. Later, Carson's catalogue appeared, showing a $2\frac{1}{2}$-in. gauge "Cardean" hauling a small boy—ridiculed in "opposition" firms' catalogues—and Carson's guaranteed that their $2\frac{1}{2}$-in. gauge jobs would pull a load of 56 lb. continuously. The first $2\frac{1}{2}$-in. gauge engine to pull an *adult* passenger, of about 8 stone, was Mr. W. Briggs's 4-4-2 "Charles Rous-Marten," an inside cylinder job of his own design, for which I made the valve-gear ; this was about 1921. The engine is still running ; she has had one "heavy shopping" only.

The pioneer of the "mighty haul" was the late Tom Averill, of Alcester ; but he did it in "one-inch-scale." His engines were beautiful jobs, and followed full-size practice, for he knew all the drivers at the local G.W.R. sheds, and got them to come along and test his engines. I well recollect that one of them refused to believe that a "one-inch-scale" engine would haul his weight with the lever one notch off middle, until she actually did it. We can do that in $2\frac{1}{2}$-in. gauge now!

The era of popular passenger-hauling by coal-fired engines in the smaller sizes was started by "grand-nanny Ayesha" at the Caxton Hall, followed by these notes, which "spilled the beans" on how to do it. The first gauge "1" engines to haul living loads were the "Lizzie" (the first complete locomotive described in these notes), a similar engine rebuilt from a commercial job, and my 4-6-4 tank engine "Eileen." The "Lizzie" (Ford Pacific) was spirit-fired, with a water-tube boiler, cylinders $\frac{9}{16}$ in. by $\frac{7}{8}$ in., and $2\frac{1}{2}$-in. coupled wheels. The rebuild was of similar type, but with $\frac{3}{4}$-in. stroke cylinders and 2-in. wheels. "Eileen" was a copy of the 4-6-4 Lancashire & Yorkshire tank engines designed by George Hughes. She had a coal-fired Belpaire boiler, with a grate 3 in. long and 1 in. wide ; cylinders $\frac{1}{2}$ in. by $\frac{7}{8}$ in., and $2\frac{1}{4}$-in. coupled wheels.

The first gauge "O" locomotive to haul an adult passenger was my Southern Pacific "Sir Morris de Cowley," and she did it over 20 years ago at the Model Railway Club Exhibition at the Kingsway Hall, the driver being the late Bill Irvin of the L.N.E.R., who weighed over 11 stone at the time. Small-gauge passenger hauling is such a commonplace at the present time, that it is difficult to believe that the idea was ridiculed less than 25 years ago.

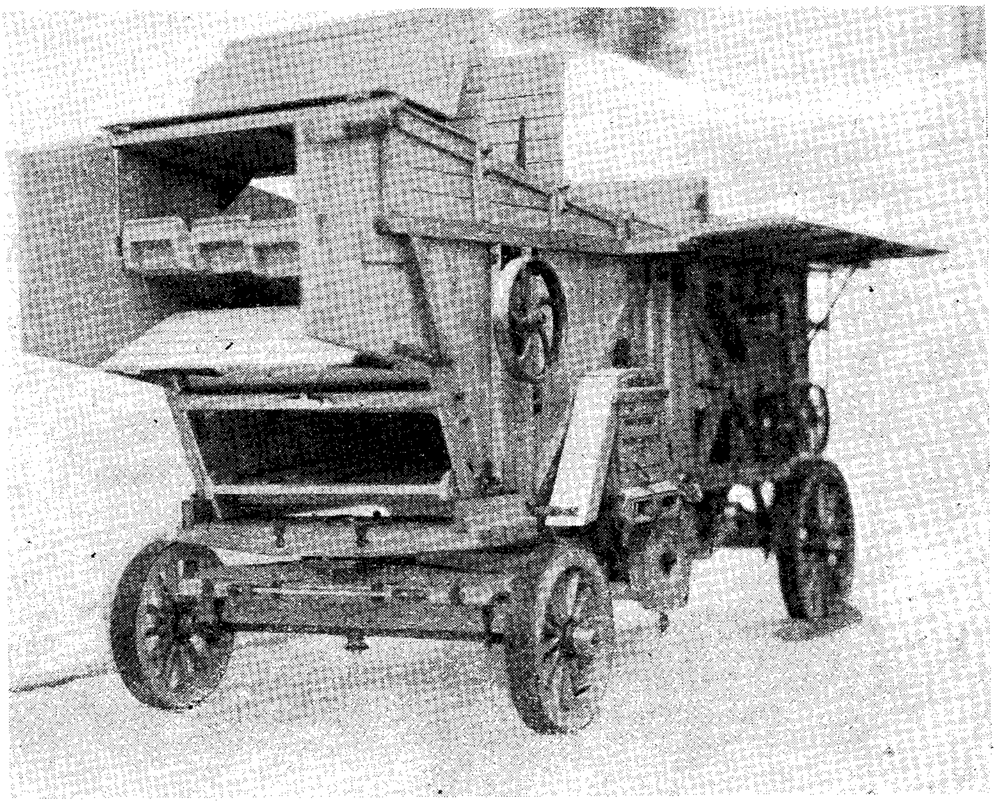
*A Model Thrashing Set

by F. G. Bettles

WELL, back to the frames again. As nearly all the bolt-holes, to hold bearings, etc., go through sideways, the frames must not be glued up, or the match-boards put on until all bearings are fitted. Therefore, the frame has to be made so that it can be taken down, until all is on.

spreaders ; the spars across shakers are matches with heads cut off ; these were scale size.

The lower chaff screen has stepped boards, with hundreds of $\frac{1}{8}$-in. holes in it. I planed up a mahogany block the correct size, marked out and drilled the holes under drilling machine,



Front end view, showing shakers and screens

then cut it up into 3/32-in. boards. This method saved splitting between the holes. All the large pulley wheels are of the carved spoke variety and have either three or five spokes per wheel and are very light (except the screen crank-wheel). I was determined to have these exactly right, as it would otherwise spoil the appearance of the machine. To make patterns for one of each was going to be a job, and I doubt if they could have been cast, as the sections were very small! ; then I found some $\frac{3}{8}$-in. thick mild-steel discs, scrap from a gas-cutting machine ; there were enough for making the larger wheels. They were turned first as discs, the spokes marked out and cut out with Abrafiles,

All the bearings were machined out of the solid, and there are thirty-two of them. The drum components are three steel discs and two mild-steel rings, with eight beaters ; after assembly on shaft, it is balanced on knife-edges. The bolts to hold on beater must be good, and mine were made out of car-wheel spokes. The shakers must be made exactly the same weight, width, etc., and a jig was made to fit on bearing which must be, centre-to-centre, the same distance apart as the shaker cranks. The shaker bearings are beech blocks, carried on fabricated

*Continued from page 602, " M.E.," December 4, 1947.

then all were filed to correct shape. The spokes are oval and each wheel took five or six hours.

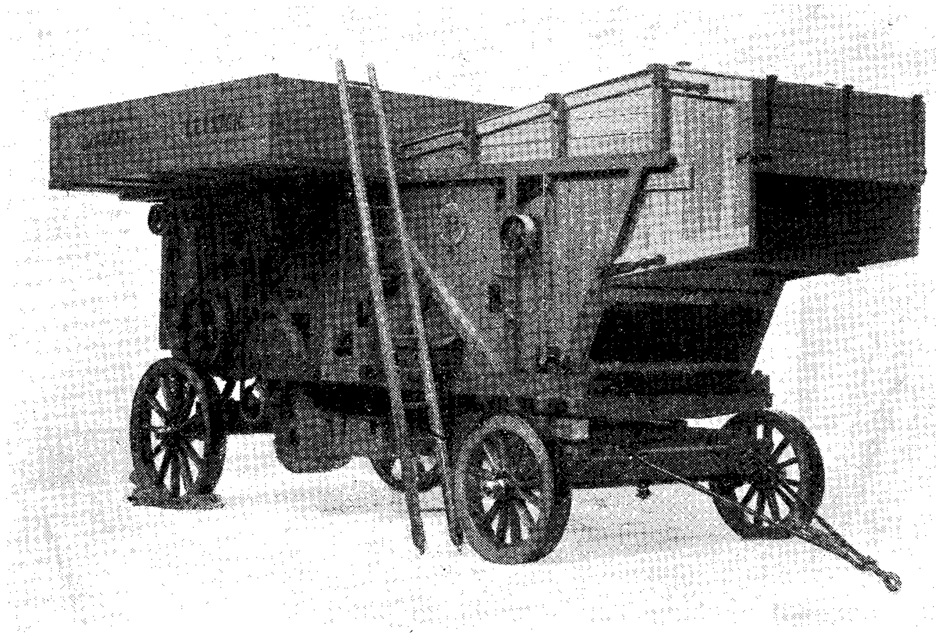
The straight shafts are of silver-steel with bearing collars forced on and key-ways cut in; all pulleys are put on with correct jib-keys.

There are four blast fans, and these have off-set blades. The revolving screen was a tricky job; the shaft of this, ¼-in. diameter, had to be drilled up for about 3 in. to carry a screw that extends or closes the spiral wire on the screen; then two 1/16-in. slots milled at 180 degrees had to be cut to admit the tongues of the nut fixed on that end of screen body. The end of screw is brought out so that a handle can turn it to adjust for correct sample of corn required.

I was rather tired of making iron wheels, so decided to fit wooden ones, and not being a wheelwright, I jumped out of the frying-pan into the fire. I had seen plenty of these made years ago, and started by putting the spokes into stocks first, as usual, but soon found I could not spring them enough to get felloes on tenons of spokes without breaking the spokes. This was disheartening, as I was set on wooden wheels.

s.w.g. steel sheet; scarfed and brazed the joint. I think I could have forced these on cold, with care, using the vice and a bit at a time all round; but I tried the hot method and in the end I don't know who was the hotter, me or the tyre. I first burnt the wheel, got the tyre half-way on and it was cold again. Luckily the wheel rims were over-wide, so this was turned off. Then I scarfed a new tyre; after carefully fitting, I tinned the scarf and pulled it up tight with another clip, applied a very hot iron to the joint and, at last, I had my tyres on as I wanted them.

No castings whatever were used; all hanger-brackets, angle-stays, drum bearing brackets, etc., were fabricated, mostly from 16-gauge brass, to scale. It is not advisable to use small steel bolts in oak, as they rust badly, and as I had to make all the bolts and nuts, I cut up 18 ft. of 5/32-in., ⅛-in. hex. brass rod. Also, a lot of coach screws are used in the large machine. I made mine by turning down wood screws, forcing on a blank nut, brazing it on and then turning again to clean off surplus spelter. There are also numerous hinges, wing-nuts and the



Front off-side view

In desperation, I tried the reverse way, and drove the spokes into felloes first and got a lengthened "Jubilie" clip and pulled the whole lot up; the centre had a ½-in. pin put in to arrange spokes correct, and a spot of glue applied to these after it was set. The wheel was put in the self-centring chuck and centre-bored to take the flanged hubs.

The tyres were another problem to be solved. These are always put on red-hot on large wheels, so I tried it. Oh! I cut the tyres from 16

smallest of wood-screws. I used three gross of 00 × 3/16 and a ¼ in., and I have to thank a friend in Bristol for these.

I made a press-tool to blank out the cups for conveyor belts. The parts inside run very close to each other, and this may cause trouble if wood is not good and dry.

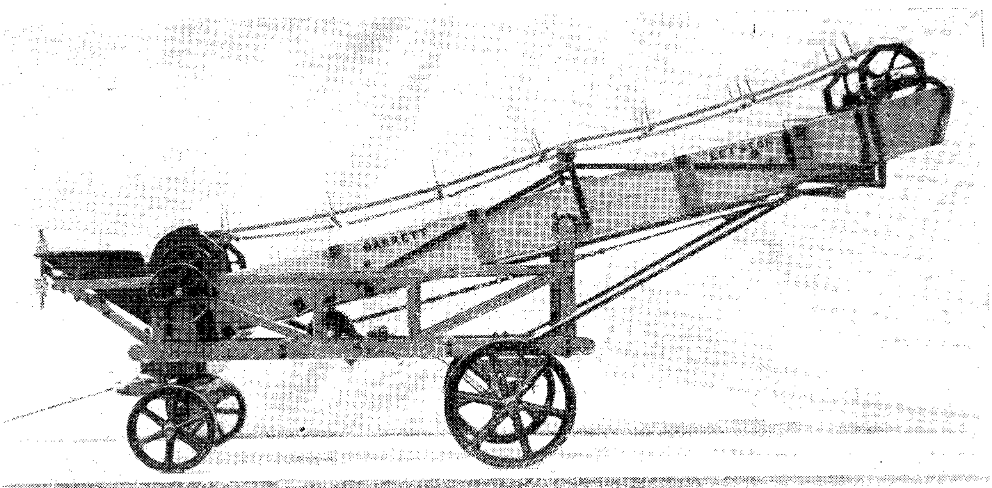
On first trial, although it was stiff, with its thirty-two bearings, the model did not throw a belt. I watched those shaker-cranks, but all was very quiet and sweet. There was one thing

missing: the drum did not hum. I suppose this is owing to its small diameter; only a whiz is heard.

The model fascinates nearly everyone who sees it. Will it thrash corn? Well, just consider this: it's to scale, $1\frac{1}{2}$ in. = 1 ft. I have worked out as near as I can from an average grain of wheat; that it is like feeding coconuts into a large machine, the straw is as big as

1/16-in. diameter for 5/32-in. long, to fix the spreaders to the links of chain. All this was done in my 5-in. lathe, after each link had been drilled with two countersunk holes to take screws into the sides of spreaders.

The gearing for raising the trough starts with mitre wheels on the shaft that goes right across the frame; one of these drives a single-start worm which in turn engages on a large worm-



The straw elevator, with trough lowered

broom handles! I tried cabbage and wall-flower seed; she gobbled them up, and what a game I had cleaning it out after.

I could write a lot more about the model, but I must leave it for now. In concluding, I would add that in my 40-odd years of model engineering I have built three traction engines, one road loco. and part of another, stationary steam, gas, oil and petrol engines, dynamos and motors, besides making most of my workshop tools, including milling-machine, two drills, linisher, saw bench, dividing-gear and milling and grinding attachments. I thought the road loco. was tough, but this thrasher was by far the most difficult job I have ever done. You can get at the works on most jobs, as they are mostly outside, but 75 per cent., I should think, are inside a thrashing-machine. I am pleased, now, that I tackled it, if only to prove it can be done; but it is very slender work and must be good or it will shake to pieces; and it must be able to take to pieces, if required, at any time.

The Elevator

The elevator was a much more simple job than the thrasher, as all parts are accessible, and I think the photograph will explain most of it, as regards layout.

The chain assembly, however, was a bigger job than I think it appears, and contains no less than 583 separate bits. I made jigs for cutting off the links of chain and also for drilling it, and another for the spreaders which carry the rakes. On the ends of these are fitted two flat plates 3/16-in. × 1/16-in. flat; there are about 70 in all, and these had to be turned down and threaded

wheel that drives the shaft which carries the two chains for raising or lowering. The arms to which these chains go are fitted with rollers running in channel-irons under the trough.

The drive from the thrashing-machine is by belt; on to a large pulley with a 3-to-1 gear reduction which drives the lower pair of octagonal chain-wheels, and the top pair run in guides and are adjustable.

I wanted cast-iron road wheels, as ours used to have these, and after making the patterns I could not get them cast. It was only a few weeks to the MODEL ENGINEER show, so in desperation I wrote to our old friends, Stuart Turner Ltd., and as a very special favour they obliged. The octagonal chain wheels were cast, solid centres, and spokes cut out afterwards; this was to save two patterns, as mine are right and left hand.

The frame is oak, and all brackets and angle-stays were built up, or milled out of the solid. Again I had some trouble to get a piece of deal free from knots, etc., to form the sides of the trough, and as all bolts used in wood are generally cup-headed, I turned dozens from 3/16-in. round rod down to 1/16-in. diameter to fix on all the fittings.

I must, in conclusion, thank Messrs. Garrett for their help in supplying photographs and catalogue of the machine.

I know I have left out a lot of very interesting details in the construction of all these models, but I trust I have made it interesting to fellow readers, but as most will realise, you can't put five years' work in a simple article, and really by now I forget how actually I did make some of it.

*A Simple All-Metal Pantograph

Its Construction and Use

by H. D. E. Goodall

THE tracer point is shown in Fig. 8 and is made from $\frac{3}{16}$ in. brass rod, the steel point being a tight fit in the stem. A $\frac{1}{16}$ in. diameter hole is drilled through the stem to correspond with the hole in the sliding fitting.

The pencil holder and lifting device is more complicated, but there is nothing difficult to make or assemble.

It consists of a pencil holder *A* (Fig. 9), which is a sliding fit in the tubular portion of the sliding fitting (Fig. 5), a bracket *E* which fits on the upper portion of the same tube and carries the pulley *C* and the fulcrum for the lifting lever. One end of the latter carries the pin *G* operating in the slot in the clip *D*, which is clamped to the pencil holder *A*. A force on the thread H causes the lever to lift the pencil off the paper.

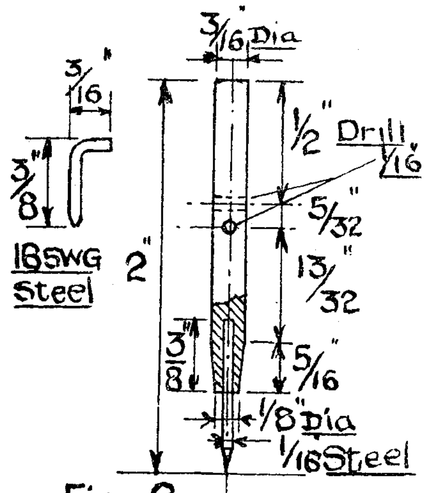


Fig: 8

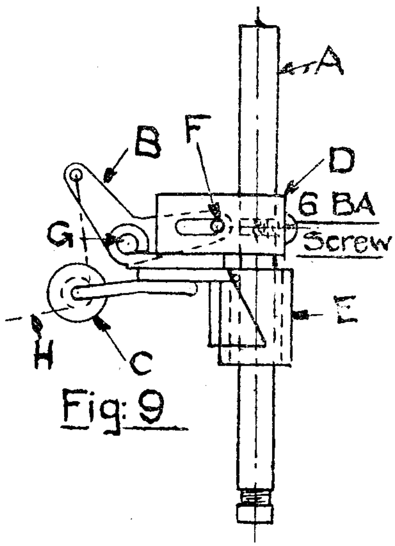


Fig: 9

The pencil holder is made from $\frac{3}{16}$ in. brass rod, having one end drilled and tapped 4-B.A. (Fig. 10), the lead holder being screwed to fit, and has a sawcut down one side. The end is tapered so that when tightened the holder will grip the lead.

Square off both ends of a $\frac{1}{2}$-in. length of $\frac{5}{16}$ in. × 20-s.w.g. brass or copper tube (Fig. 11) and make it a sliding fit on the tubular part of the sliding fitting. Cut a piece of 16-s.w.g. brass sheet to dimensions given on Fig. 11, bend and form the flanged part to the contour of the tube; this can best be done by bending it round a piece of rod of the same diameter as the tube, as nearly as possible and finishing with a round file.

Using 16-s.w.g. brass sheet form the fulcrum part and remove the centre portion of the turnover to take the lever.

The pulley, together with the clip, can as stated be obtained complete. The clip portion requires bending as shown and the top surface filed to produce a flat bearing surface; all the plating around the part to be soldered should be removed.

The tube and bracket should first be sweated together, next sweat on the fulcrum part and pulley clip, taking care not to let the bracket and tube get too hot. Clean and finish.

Make up the lever, Fig. 12, from 16-s.w.g. sheet; making the hole *A* a light tapping fit for 14-s.w.g. brass wire.

The clip for the pencil holder is shown in Fig. 13, and is made from 16-s.w.g. brass sheet, by bending the brass sheet round a $\frac{3}{16}$-in. diameter rod.

Assemble the pencil holder as shown in Fig. 9.

The fulcrum weight consists of a weight of about $1\frac{1}{2}$ lb., and carries the fulcrum pin and has four spikes on the underside to prevent sliding (Fig. 14). The fulcrum pin is placed eccentrically to avoid, as far as possible, the interference of the weight with the travel of the screw in the joint of the two short beams.

The weight should be made of lead, if available, or failing this brass or steel may be used. Or it may be built up of sheet secured by rivets, in which case the edges should be sweated and finished smooth. The fulcrum is of $\frac{3}{16}$-in. diameter brass rod and is sweated in place and finished smooth. The spikes on the underside

*Continued from page 605 "M.E.," December 4, 1947.

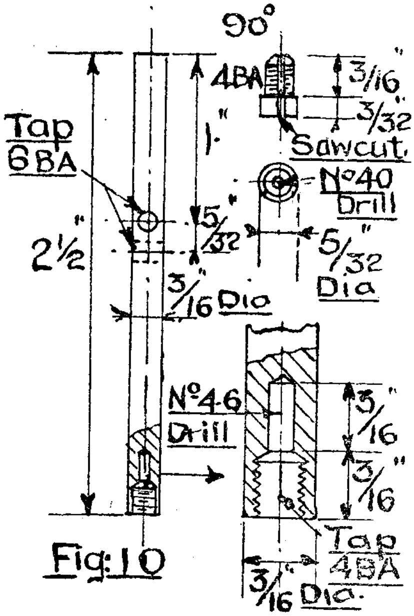


Fig: 10

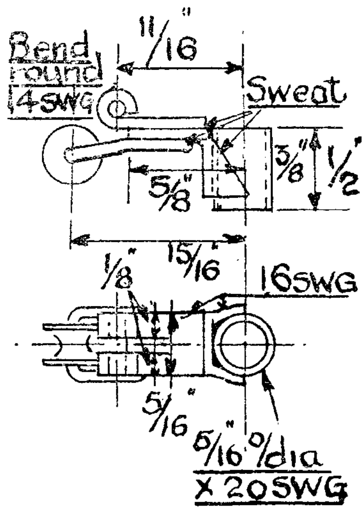


Fig: 11

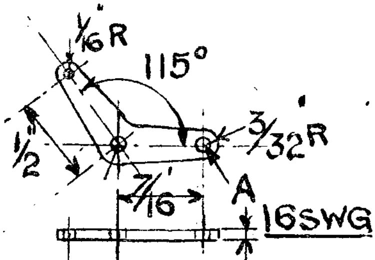


Fig: 12

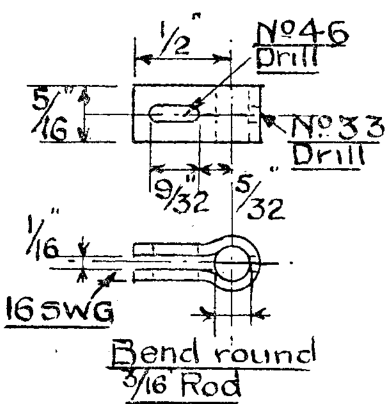


Fig: 13

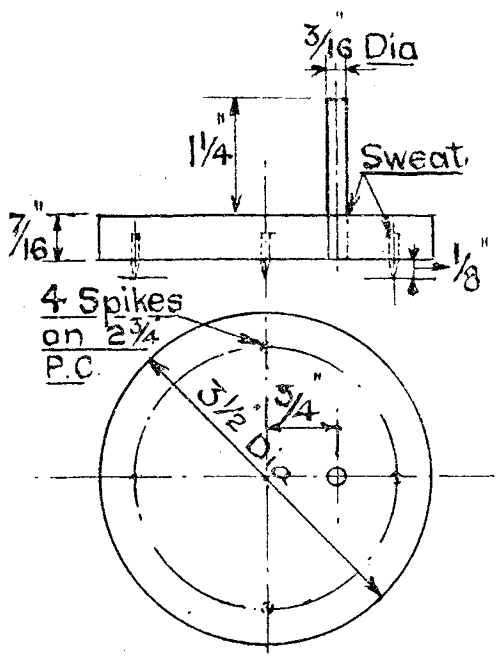


Fig: 14

are made from $\frac{3}{16}$-in. diameter steel and are sweated in.

A weight is necessary to give the required pressure on the pencil point and for this purpose a weight of $1\frac{1}{2}$ oz. is about right. A convenient shape for the weight is cylindrical with a $\frac{3}{16}$-in. diameter clearance in the centre. For an outside diameter of $\frac{3}{4}$ in., the lengths could be: lead $\frac{9}{16}$ in., brass $\frac{3}{4}$ in., steel $\frac{13}{16}$ in.

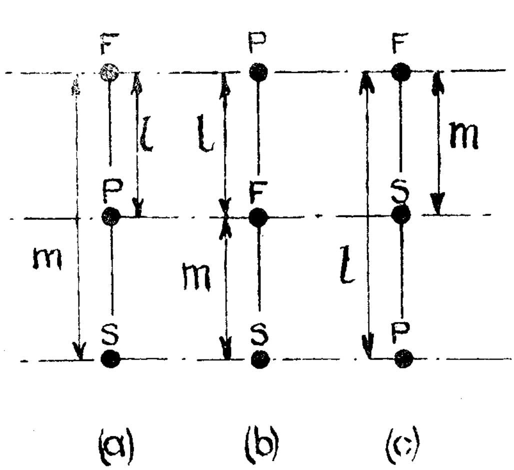


Fig: 15

After assembly of the instrument, it only remains to make the final adjustments for use.

A piece of pencil lead, preferably of grade HB or B, is fitted in the holder and the end sharpened to a taper point (not a chisel point).

The fulcrum, pencil and tracer can be used in any of the three arrangements shown in Fig. 15. To set the instrument, the relative distances between the points must first be determined. The ratio of the scale of the copy traced by the pencil to the scale of the original will be l:m, that is,

$$\frac{\text{Scale of } P}{\text{Scale of } S} = \frac{l}{m}$$

If it is desired to reduce the original to, say, two-thirds of its size, then $\frac{l}{m} = 2/3/1 = \frac{2}{3}$ and if the distance from the fulcrum to the pencil is 4, that to the tracer must be 6. It will be noted that this ratio can be used with arrangements (a) and (b) only (Fig. 15) and that (c) can only be used for enlargements, i.e., where $\frac{l}{m}$ is greater than unity.

In setting these points, it is essential that all three are in an exact straight line, otherwise the copy will be distorted.

A simple gauge (Fig. 16) can be constructed which will facilitate this setting procedure, and at the same time automatically ensure true alignment.

In a strip of 16-s.w.g. brass $\frac{3}{4}$ in. wide, drill the holes and form the slot as shown in Fig. 16, taking care that the holes and the slot are truly central about the centre line. In the holes place No. 2-B.A. round-head brass screws and secure permanently with 2-B.A. nuts underneath. Place in the slot, with washers on both sides, a third 2-B.A. round-head brass screw, secured with a 2-B.A. nut; this is the adjustable pin.

To set the gauge, adjust the screw in the slot, such that the ratio of the distances between the screws is equal to that required. For example, suppose that the ratio required is 4 : 3. Now the distance between the fixed pins is 5 in., therefore the distance from the centre pin to that in the slot will be ($\frac{3}{4} \times 5$) or $3\frac{3}{4}$ in.

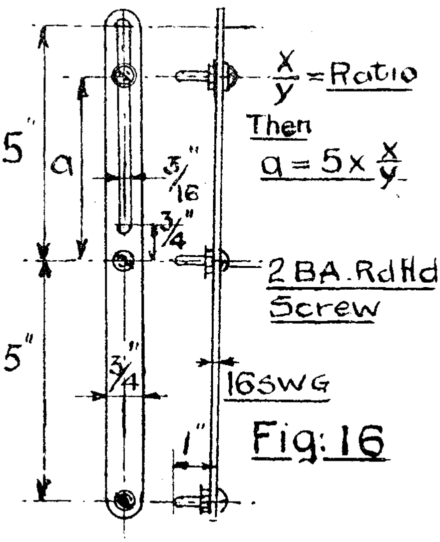


Fig: 16

To use the gauge, loosen the screws holding the sliding fittings, and adjust the positions until the three gauge pins enter the tubular portions of each of the fittings and then re-tighten the screws.

The lifting device is operated from the lever on the bracket (Fig. 7) through a thread passing round one or more pulleys, as convenient and attached to the bell crank lever *B* (Fig. 9). The run of the thread must be arranged so that it follows the beams and therefore does not affect their movement

The instrument should only be used on a level surface, such as a drawing-board. The fulcrum weight should be pressed down to enable the spikes to penetrate the surface and the original drawing and the paper for the copy pinned in their relative positions, checking that the extreme points on the original are well within the compass of the copy paper.

It will be found that a fair amount of practice is required before the tracer point can be passed accurately over the original and avoiding wavy lines on the copy, and the necessity for smooth working of the whole mechanism will be appreciated. The application of a spot of thin oil on the various joints and bearings will be found a considerable help to smooth working.

Fairing a Ship's Lines

by J. Melville Thompson

IN a previous article (THE MODEL ENGINEER, Vol. 96, No. 2396, April 24th, 1947) on altering a boat design, mention was made of "fairing." It appears that quite a number of model makers do not know quite what is meant by this or the best way to go about it. When a design has been roughed in, a properly-conducted "fairing up" will result in a set of lines that is *bound* to look good to the eye. No matter how roughly the first sketch is made, fairing will pull it into presentable shape. The method described here is the one adopted in designing anything from a battleship to a 10-ft. dinghy, and it ought certainly to be used by those model makers who are rather inclined to look upon the hull as a convenient wrapper for an engine.

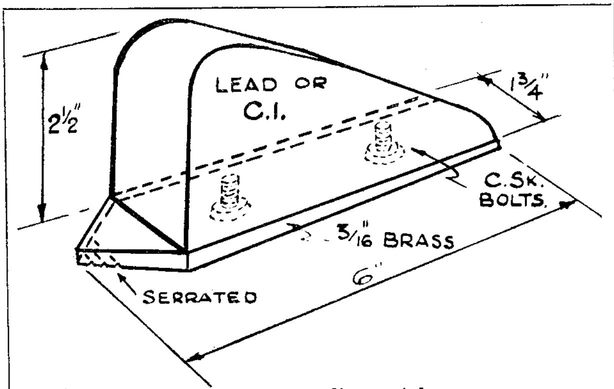


Fig. 1. A spline weight

It is imperative to use a good sharp pencil, not softer than H. The point will last longer if it is sharpened like a long, tapering chisel. Splines, or penning battens, are better bought, as it is important that they should be the same or an evenly tapered section throughout. Three sizes should be enough; a stiff one, parallel throughout, of $\frac{7}{16}$ in. × $\frac{1}{8}$ in. celluloid, is extremely useful, another about $\frac{1}{8}$ in. square tapering to about $\frac{1}{16}$ in. square will take most of the long curves, and a sliver about 1/32 in., although awkward to handle, will be needed for sharp curves. If an attempt is made to make them, use celluloid or lancewood for preference, but sycamore, pear wood, any pliable plastic, or even plywood or steel, will make adequate substitutes for occasional work. The vital thing is that they should have no humps or hollows or knots to cause uneven bending. Weights are usually made something like that shown in Fig. 1. The base can be wood instead of brass, in which case it should be teak, at least $\frac{5}{16}$ in. thick. But any heavy weight will do—a flat-iron, a lump of steel or whatever comes to hand, if it is only intended to do one job. Improvisation, however, does not promote accuracy. The only other tool required is a large quantity of strips of paper about $\frac{3}{4}$ in. wide. The drawing should be made on stout cartridge paper, linen-backed, if obtainable. To be really painstaking, one should damp it first, stretch it taut and glue or pin it down. Paper will expand and contract a good deal. For this reason lines are drawn in some shipyards on marble slabs—a chilly form of accuracy!

Constructional lines must be carefully drawn and be at true right angles to each other. Never depend on tee-square or set-square. Make one datum line and measure all other lines from it. This may sound very fussy, but in this kind of work it pays. The slightest inaccuracy in the constructional lines will cause no end of trouble. The spacing of these lines will depend on the type of craft being designed. In large ships of the merchant class it is usual to space waterlines and buttocks 2 ft. apart, and to divide the length into ten spaces making eleven sections, or ordinates suitable for calculations in the Displacement Table, using Simpson's Rule. For smaller work a closer spacing is desirable. Some divide the distance between the base line and the load waterline into an equal number of parts to make waterlines, again to simplify calculations. One can please oneself. Too many is better than too few. Intermediate ordinates should be introduced between Section 0 and Section 1, Section 10 and Section 11, or whatever sections there are at the ends, where the shape is liable to change suddenly. To make the illustrations clearer only five sections, one waterline and one buttock have been shown. What applies to these will, of course, apply to the rest. I hope there will be none to take me to task for not calling the horizontal planes above the L.W.L. "level lines" and the longitudinal vertical planes forward of midships "bow lines" instead of buttocks. I think this is pedantic. It is common among semi-amateur yacht designers and it appears to serve no other purpose than to show a knowledge of what was customary in the last century. I also hope that no one will write angry letters about the shape of the boat given as an example. It is not intended to be any particular type of craft and was distorted where lucidity seemed to call for it.

It is conventional to draw the bow at the right-hand side and to put the fore end sections on the right of the body plan. It is more than just a convention. Yard drawings are always made like this, so that when only a part of the ship is drawn it can always be taken for granted that anything to the right is forward and anything to the left, aft. There is no need to make the kind of mark indicating N that one sees on architects' site plans.

Now to get started!—draw, in each of the three views, everything that has at that stage been

decided. The length, the breadth, depth, sheer line, size and rake of keel (if any), midship section, stem, stern, plan of deck line and, perhaps, the load waterline. There is nothing empirical about these except one's own requirements and the laws of naval architecture—matters outside the subject of this article. Having done this, get on with the body plan (see Fig. 4). Sections can be based on a previous design, as described in "Altering a Boat Design," or they can be put in by sheer guesswork. To described a theoretical method would take a long time and the methods vary for different types of craft. One may have three spots to work from—the width and height at the deck, the width on the load waterline and the position at the keel. The manner in which the deck height is transferred to the sections is shown by arrow marks for Section 3. The midship section having been already fixed, rough in a section that follows it *sympathetically*. This is not technical language, but neither is fairing a purely technical procedure. Some have it that it is an art, but that is exaggerating. All the sections can be roughed "sympathetic" to each other, making a symmetrical pattern of the sectional view. Then starts the real job of fairing.

A strip of paper, X, is laid along a waterline. The centre line or middle line, is marked on it, C.L. or M.L. Then the points where the proposed sections cross the waterline are marked, 1, 2, 3, etc. This paper with the spots marked on it is then placed on each section on the plan view (as shown at Section 4), the distance of No. 1 Section from the C.L. marked off on No. 1 Section on the plan view, the distance of No. 2 from the C.L. marked off on No. 2, and so on. When they are all plotted these sections ought to give a true curve—but they won't! They are tested with a batten. Place a weight on the batten at the point of maximum curvature, A. Bend the batten by hand round to the point where it should end on the centre line or keel line (this has been measured down from the elevation and will vary for each waterline). Place an intermediate weight, B, and an end weight, C, to fix it somewhere near the points on the sections. Do this, if possible, (some curves will not allow it) on both sides. The batten must not be too stiff to take the curve easily nor so slender that it will curve like a snake. If it is found that some of the points are nowhere near this natural curve and even extra weights will not bring the batten to them, it is pretty certain that the points are wrong. Except where there are very sharp changes in form towards the aft

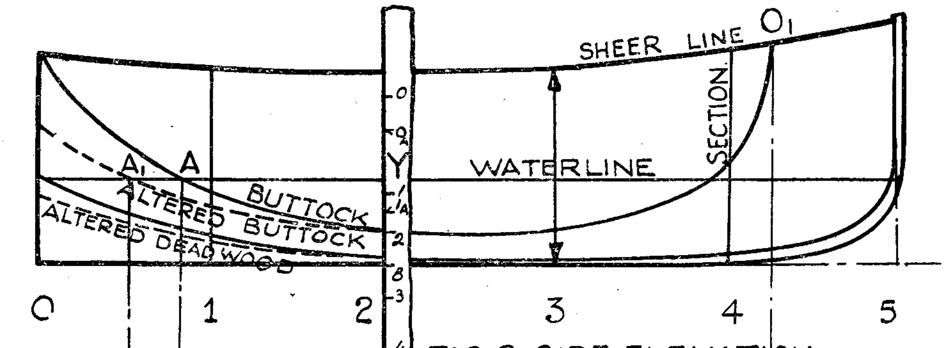


FIG. 2 SIDE ELEVATION.

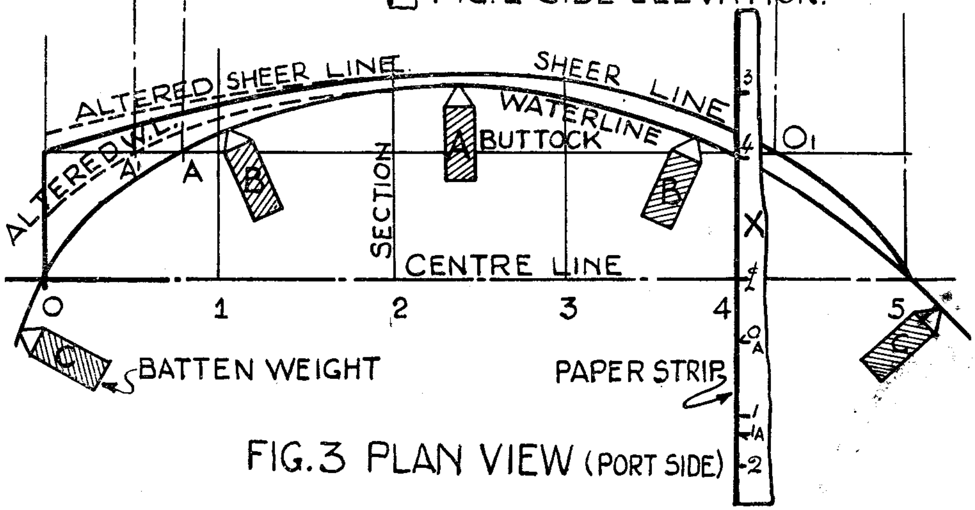


FIG. 3 PLAN VIEW (PORT SIDE)

end, six weights are enough for any waterline and most buttocks. Draw in lightly what appears to be the true waterline and go back with the new measurements to the body plan, Fig. 4. Alterations usually get a special mark and this is effective if there are not too many of them. Before fixing the altered sections, try out a buttock line as shown by the strip marked Y. Here the strip is laid vertically along the buttock line, the baseline marked B, and the heights of the intersections of the sections with the buttock line marked 1, 2, 3,

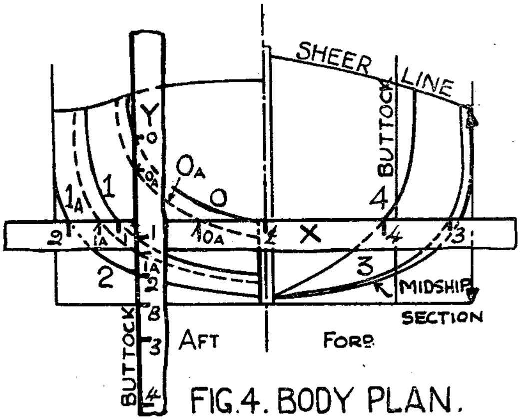


FIG. 4. BODY PLAN.

etc. This is done at the same time on both halves of the body plan, Fig. 4. Take the strip to the elevation (shown at Section 2, Fig. 2) and mark off the heights of the buttock intersections above the base on each section. Before drawing this curve project up from the plan view the intersections of the buttock with the deck line, as at o_1o_1. This will fix the ends of the curve. Draw this with batten and weights as for the water line, working upside down. It is a temptation on a difficult buttock to use parabolic curves—resist the temptation! If the points on this need altering, take what appears to be the true points back to the body plan, Fig. 4, and it is practically certain that they will confirm what has been found needs altering by the waterline. Alter the section, but do not be too definite, other waterlines may alter it again. So one goes on, trying and correcting until one is quite satisfied that every line corresponds in plan, section and elevation and that each is sweet and easy-flowing.

An alteration of a drastic nature has been shown at the aft end of Figs. 2 and 3. It was first made in the plan view. The intersection of the buttock with the waterline at A now becomes A_1. This was carried up to the elevation by measuring its distance from Section 0. The altered buttock was drawn in lightly and the new spots for 1 (shown with a special mark) were tried on the body plan and at the same time compared with the half-breadths on the plan view. When all agreed and every waterline, section and buttock that had become affected by the alteration had been made to correspond, that part of the job was complete.

Of course, in designing, one has to know what one wishes to achieve by an alteration. In this example, presuming the waterline under consideration was beneath the load waterline and not above it, the alteration has increased the calculated displacement, and moved the centre of buoyancy aft. One does not do things like that with impunity. At least, anyone who doesn't want to load his boat with ballast *shouldn't*!

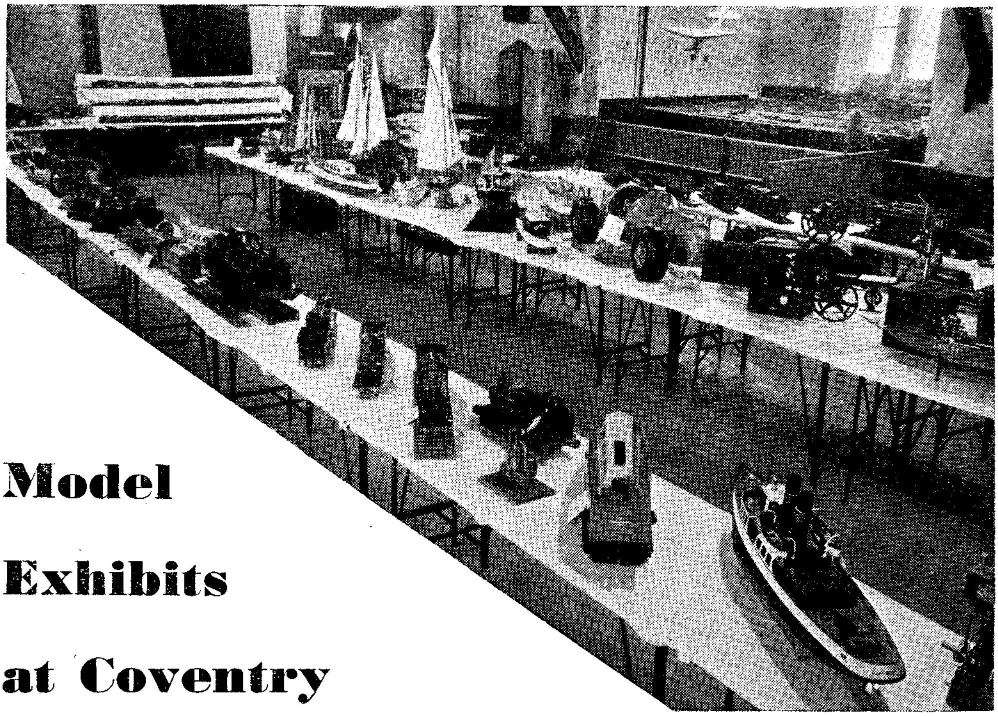
For the Bookshelf

How to make a Telescope, by Ernest F. Carter. (London: Percival Marshall & Co. Ltd.) 55 pages. Size $7\frac{1}{4}$ in. by $4\frac{3}{4}$ in. Illustrated. Price, 3s. net.

The student of astronomy frequently finds that the acquisition of a suitable telescope is a difficult problem to solve, chiefly on account of the financial outlay involved. To construct a telescope, however, does not require more than average skill and workshop equipment, and the financial outlay necessary is comparatively moderate. This book is a good practical guide to the subject: it explains clearly all that is required in the way of material, lenses and the like, and shows by means of numerous drawings how they are fashioned and assembled to produce a useful working instrument of moderate power. Methods of mounting telescopes on suitable stands are also discussed and illustrated, and there is much subsidiary advice on matters relevant to the subject.

How to make an Electric Clock, by R. Barnard Way. (London: Percival Marshall & Co. Ltd.) 53 pages, size $7\frac{1}{4}$ in. by $4\frac{3}{4}$ in. Illustrated. Price 3s. net.

A compact and useful handbook based on a popular series of articles which were published a few years ago in THE MODEL ENGINEER. In these days, when electric power is so readily available in many homes, the electric clock is a much-sought-after item of household equipment, and many people succumb to the desire to make one. This book contains practical information and advice on how to construct a simple but handsome clock requiring nothing very elaborate in the way of materials and tools. The general design is capable of considerable variation to suit the ideas of the constructor, or the decorative scheme of the home, without alteration to the electrical items included in the assembly. We can confidently recommend this book to the owner of even the most modest of workshops.



Model Exhibits at Coventry

THE Coventry Model Engineering Society held its first post-war exhibition at Trinity Schools from October 23rd to 25th, and a very successful show it was.

The opening ceremony was performed by His Worship the Mayor of Coventry at 2.30 p.m. on the Thursday, and from that time onwards the flow of visitors never slackened. Our records show that something like seven thousand people passed through the hall.

The standard of workmanship was very high and many classes of exhibits were shown, including some unique models.

The " OO " gauge section put on a remarkable and picturesque working layout occupying a space of 8 ft. by 15 ft., and the work was all the more meritorious in view of the limited time available in which it was assembled.

Of course, the live-steam passenger track was in operation and the demand for rides necessitated a continuous service of trains. Possibly the desire to explore the world beyond the yawning, black tunnel-mouth tempted more than the normal number to undertake the journey. Locomotives in steam were of both $2\frac{1}{2}$-in. and $3\frac{1}{2}$-in. gauge, the three former having all worked at the local club exhibitions before the war! An industrial-type 0-4-0 tank engine and a Southern Railway " 736 " class engine, both of $3\frac{1}{2}$-in. gauge made their debut this year, the latter having the honour of being driven by the Mayor. There were no failures of any kind.

Marine Models

Ship models worthily upheld past traditions of workmanship and in variety ranged from a Chinese junk to H.M.S. *Warspite*, several fine sailing yachts being included. A real gem in this class was a cabin cruiser built by a member while a prisoner of war in Germany, and the beautiful workmanship and graceful lines of this model are all the more creditable considering the great difficulties encountered in its construction due to limited tools and shortage of raw materials.

Many examples of petrol engines were shown and several were persuaded to run from time to time in order to give the loudspeaker a rest. Petrol race-cars were also much in evidence.

Several stationary engines were included, some being run on compressed air, as also were a partly finished " Princess Marina " chassis and a " Dyak " locomotive.

Variety

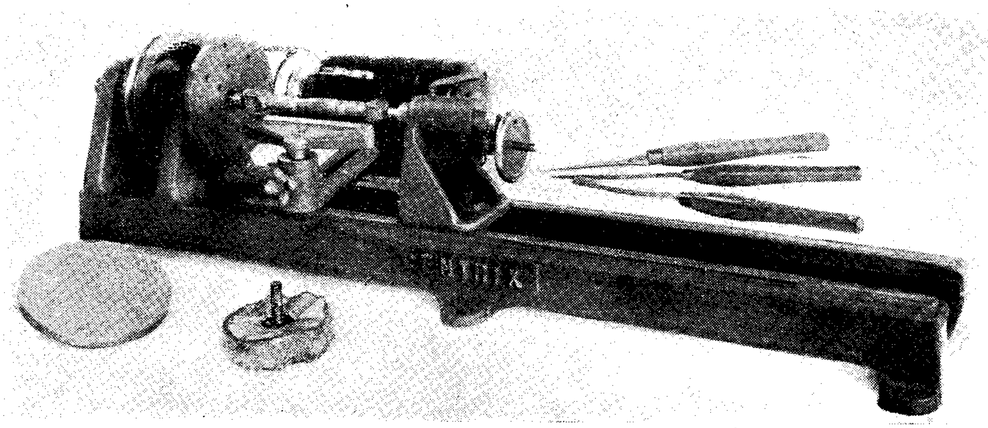
A cine-projector, mechanical excavator, naval gun, an exquisite electric clock (the sole timekeeper for the show), a 15-cylinder radial aero engine, two electric tramcars, and several workshop accessories must also be mentioned.

The sincere thanks of the club are due to our friends of the Northampton, Birmingham, and Leicester societies who contributed many excellent models. We also wish to express our gratitude to the many local " lone hands " whose work on show added to the interest and variety.

Lastly, we cannot forget the exhibitors' wives and lady friends, without whose help and encouragement many of the models would never have been built, and who nobly did duty on all manner of jobs during the show, including that most essential of all tasks, namely, "keeping the lions fed."

The Centrix Wood-Turning Lathe

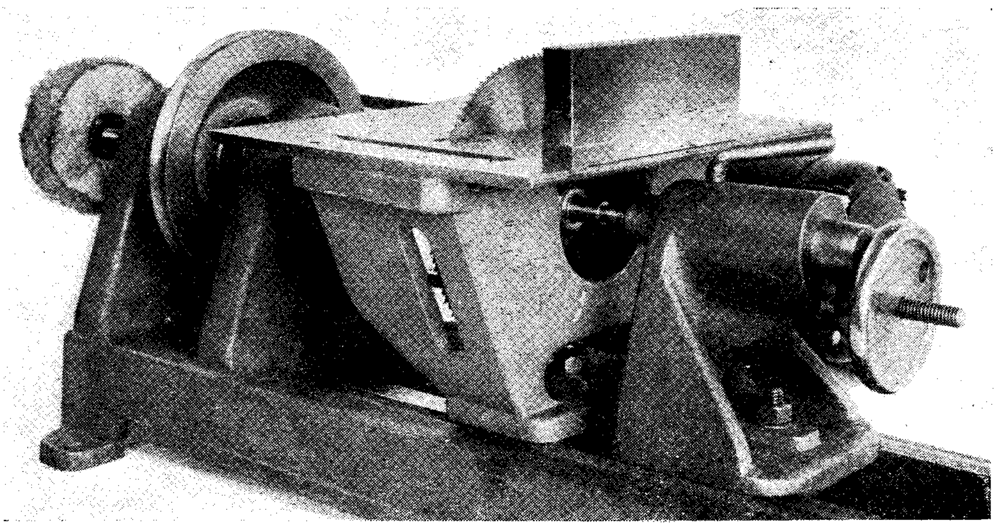
THIS machine has been produced to meet the need for a simple lathe, capable not only of plain wood turning, but also of being adapted to many other woodworking purposes. Basically, it comprises a cast bed $39\frac{1}{2}$ in. long, taking work up to a maximum length of 28 in., each being 6 in. diameter, and drilled with 12 countersunk holes to take No. 10 wood screws. A four-step pulley to take a Vee-belt is mounted on the mandrel, and when used with standard motor and pulley, provides speeds of 594, 870, 1,425 and 2,100 r.p.m.



The Centrix wood-turning lathe

and with an integral fast headstock, $4\frac{1}{2}$ in. in centre height. The mandrel runs in phosphor-bronze bearings and is hollow bored right through, $\frac{3}{8}$ in. diameter, with a No. 1 Morse taper socket at the front end, and tapped 7/16-in. B.S.F. thread at the rear. Face-plates are provided for fitting at either end of the mandrel,

The tailstock has a 1-in. diameter barrel, bored $\frac{3}{8}$ in. and socketed No. 1 Morse taper, with screw feed and locking device. It is clamped to the bed by a bolt and plate between the shears of the bed, a similar fixing being provided for the soleplate of the hand-rest, which is of the usual type, with adjustment for height. A



Circular saw attachment set up on the Centrix lathe

motor platform, attachable to the lathe bed with two bolts, can be supplied with the machine, rendering it an entirely self-contained motorised lathe, applicable in this form to turning, drilling, grinding, sanding and polishing

Special attachments for the machine include a saw bench attachment, having a table 10 in. long, by 8 in. wide, giving 1¼ in. maximum depth of cut with a saw 6 in. diameter, which can be decreased by the use of a dummy platform on the saw table. An adjustable fence is fitted, giving 3½ in. maximum width of cut, on either side of the saw.

A planing and rebating attachment is also available, having a table 10 in. long by 6 in. wide, adjustable for height, and having a fence to adjust width up to 3 in. The cutter is 3 in. wide, and is fitted with four inserted blades, removable for sharpening.

The above lathe is manufactured by Centrix Precision Products Ltd., Free Wharf, Shoreham-by-Sea, Sussex.

Editor's Correspondence

Triple-geared Lathes

DEAR SIR,—In reply to Mr. Anderton's letter in reference to triple back-gear, I have access to an old 5-in. ex-naval lathe which has this gear. The third shaft is driven from the usual back-gear shaft by a sliding pinion, and when in use projects forward in front of the headstock casting, engaging with teeth cut on the inside of the faceplate.

The lathe was built for treadle gear; it has a remarkable gap and right-handed feed screws.

If Mr. Anderton would like further details I shall be pleased to supply them to him.

Yours sincerely,

Nr. Bath. R. E. WINN.

DEAR SIR,—In the November 13th issue, Mr. James Anderton asks for details about a triple-geared treadle lathe used about 50 years ago in marine work.

I have a copy of *Turning Lathes*, published in 1890 by the Britannia Company, Colchester, which gives an illustration of one of their lathes, 5-in. centre, 5 ft. long bed, gap bed, which would swing a 24 in. disc, and the price was £36! (Treble geared).

Unfortunately, the illustration gives very little detail about the actual construction, but the third gear shaft was carried *above* the mandrel, with the back-gear shaft in its usual position at the rear.

Yours faithfully,

Thornton Heath. T. H. GLAZEBROOK.

Curved Cranks

DEAR SIR,—"L.B.S.C." wonders why the old scissor-grinders' wheels had a spirally curved crank, when a straight crank would have been simpler.

It is possible that these machines were driven by a leather thong in early times, instead of by rigid wooden cranks. Indeed, I have seen one or two such.

There is a most excellent reason underlying the curved crank when used in conjunction with a flexible thong joining it to the treadle. Many old spinning-wheels were so equipped, and its use was to act as a guide to prevent the crank catching the thong should the latter bend in toward the axle at the top of its stroke.

The proper direction of rotation is that by which the crank-pin "leads" the curve, and a rough sketch of such conditions will show quite clearly how the curved crank guides the thong till it is clear of the axle.

An interesting point arises in the fact that practically all the hand cranks on manually-operated machines, such as churns, grindstones, etc., had curved cranks. Was this to protect the operators' clothing from being caught up, or was it just a useless imitation of a really clever device?

Yours faithfully,

Bedford. F. C. BROWNSON.

Small Gas Turbines

DEAR SIR,—Your issue with the "Proposed Design for a Small Gas Turbine" has just come to my notice. This is extremely ingenious, and I hate to criticise it; but I consider it a fallacy to "scale nature" in this case. I would draw the attention of "L.K.B." to my articles on "Jet Propulsion" (August 14th and 21st, 1947) and my letter to A. H. Poole (October 16th, 1947), which point out some of the "scientific" difficulties inherent in such a unit.

I consider that, while the products of combustion will be sufficient to rotate the turbo-compressor shaft, it will not supply enough energy to enable the compressor to compress the intake air effectively. I have already pointed out the fallacy of running such a unit without, so to speak, a "compression stroke."

On the other hand, if the unit should function, there is no speed control over the turbo-compressor shaft. It was uncontrolled over-speeding that was one of the snags that Whittle first encountered. If the unit works, the turbine drives the compressor faster, the compressor supplies more air at a higher pressure and so the turbine is driven faster, forming a vicious circle with the r.p.m. increasing rapidly until partial or complete failure of the unit occurs. On that subject, Whittle made a classic remark to the effect that, in the early days, the staff did more running than the engine! From the "scientific" viewpoint, of course, a knowledge of the design r.p.m. is fundamental, while from a practical viewpoint, governing is essential.

Yours faithfully,

"ARTY."